Introduction to diagnostic medical parasitology

Medical parasitology: a science that deals with the parasites, that cause human infections and the diseases they produce. It is broadly divided into 2 parts:

a) **Protozoology.**
b) **Helminthology.**

Parasites: Parasites are living organisms that depend on a living host for nutrition and survival. They multiply or undergo development in the host. The term 'parasite' is usually applied to Protozoa (unicellular organisms) and Helminths (multicellular organisms).

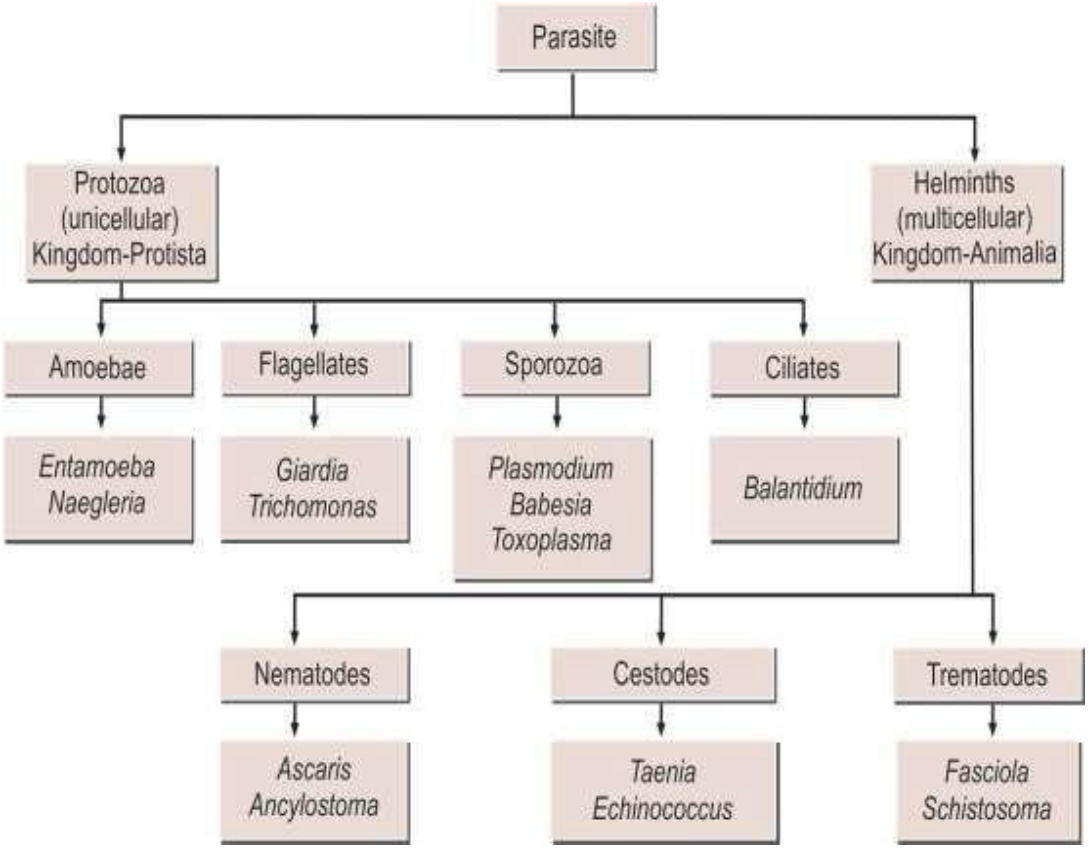
Parasites can also be classified as:

1) **Ectoparasite:** Ectoparasites inhabit only the body surface of the host without penetrating the tissue. Lice, ticks, and mites are examples of ectoparasites. The term infestation is often employed with ectoparasites.
2) **Endoparasite:** A parasite, which lives within the body of the host and is said to cause an infection is called an endoparasite. Most of the protozoan and helminthic parasites causing human disease are endoparasites.
3) **Free-living parasite:** It refers to non-parasitic stages of active existence, which live independent of the host, **e.g.** cystic stage of ***Naegleria flowery***.

   a. **Obligate parasite:** The parasite, that cannot exist without a host, **e.g.** *Toxoplasma gondii* and *Plasmodium*.
   b. **Facultative parasite:** Organism which may either live as parasitic form or as free-living form.

c. **Accidental parasites**: Parasites, which infect an unusual host, are known as accidental parasites. *Echinococcus granulosus* infects man accidentally, giving rise to hydatid cysts.

d. **Aberrant parasites:** Parasites, which infect a host where they cannot develop further, are known as aberrant or wandering parasites, **e.g.** *Toxocara canis* (dog roundworm) infecting humans.



Types of parasitic host

Host: The host is defined as an organism, which harbors the parasite and provides nourishment and shelter to the latter and is relatively larger than the parasite.

The host may be of the following types:

- **Definitive host:** The host, in which the adult parasite lives and undergoes sexual reproduction is called the definitive host, **e.g.** mosquito acts as definitive host in malaria.

*The definitive host may be a human or any other living being. However, in most human parasitic infections, man is the definitive host, **e.g.** filarial, roundworm, and hookworm.

- **Intermediate host:**

The host, in which the larval stage of the parasite lives or asexual multiplication takes place, is called the intermediate host. In some parasites, two different intermediate hosts may be required to complete different larval stages. These are known as first and second intermediate hosts, respectively.

- **Reservoir host:**

In an endemic area, a parasitic infection is continuously kept up by the presence of a host, which harbors the parasite and acts as an important source of infection to other susceptible hosts, **e.g.** dog is the reservoir host of hydatid disease.

- **Accidental host:**

The host, in which the parasite is not usually found, **e.g.** man is an accidental host for cystic echinococcosis.

Parasites with man as intermediate or secondary host

- *Plasmodium* spp.
- *Babesia* spp.
- *Toxoplasma gondii*.
- *Echinococcus granulosus*.
- *Echinococcus multilocularis.*
- *Taenia solium*.
- *irometra* spp.

Zoonosis

The word zoonosis was introduced by Rudolf Virchow in 1880 to include the diseases shared in nature by man and animals.

Zoonosis: are the diseases and infections, that are naturally transmitted between vertebrate animals and man".

Types of zoonoses:

Protozoal zoonoses, e.g. toxoplasmosis, leishmaniasis, balantidiasis, and cryptosporodiasis

Helminthic zoonoses, e.g. hydatid disease, taeniasis

Anthropozoonoses: Infections transmitted to man from lower vertebrate animals, e.g. cystic echinococcosis

Zooanthroponoses:
Infections transmitted from man to lower vertebrate animals, e.g. human tuberculosis to cattle.

Host-parasite Relationships: Host-parasite relationships are of following types

1) **Symbiosis:** Both host and parasite are dependent upon each other but none of them suffers any harm from the association
2) **Commensalism:** Only the parasite derives benefit from the association without causing any injury to the host and the commensal is capable of living an independent life also.
3) **Parasitism.:** The parasite benefits and the host is always harmed due to the association. The parasite cannot live an independent life.

Life Cycle of Parasites

Direct life cycle:

When a parasite **requires only single host** to complete its development, it is called as direct life cycle, e.g. *Entamoeba histolytica* requires only a human host to complete its life cycle.

Indirect life cycle:

When a parasite **requires 2 or more host** to complete its development, the life cycle is called as indirect life cycle, e.g. malarial parasite requires both human host and mosquito to complete its life cycle.

Parasites having direct life cycle

Protozoa

- *Entamoeba histolytica*
- *Giardia lamblia*
- *Trichomonas vaginalis*
- *Balantidium coli*
- *Cryptosporidium parvum*
- *Cyclospora cayetanensis*
- *Isospora belli*
- *Microsporidia*

Helminths

- *Ascaris lumbricoides*
- *Enterobius vermicularis*
- *Trichuris trichiura*
- *Ancyclostoma duodenale*
- *Necator americanus*
- *Hymenolepis nana*

Parasites having indirect life cycle

Parasite	Definitive host	Intermediate host
Protozoa		
Plasmodium spp.	Female Anopheles mosquito	Man
Babesia	Tick	Man
Leishmania	Man, dog	Sandfly
Trypanosoma brucei	Man	Tsetse fly
Trypanosoma cruzi	Man	Triatomine bug
Toxoplasma gondii	Cat	Man
Cestodes		
Taenia solium	Man	Pig
Taenia saginata	Man	Cattle
Echinococcus granulosus	Dog	Man
Trematodes		
Fasciola hepatica	Man	Snail
Fasciolopsis buski	Man, pig	Snail
Schistosoma spp.	Man	Snail
Nematodes		
Trichinella spiralis	Man	Pig
Wuchereria bancrofti	Man	Mosquito
Brugia malayi	Man	Mosquito
Dracunculus medinensis	Man	Cyclops

Samples for parasitic detection:

- Stool.
- Urine.
- Sputum.
- Blood.
- Serum.

Biopsy of abscess liver.
Preianal.
Sigmoidoscopy. ينيسلا نولوقلا ريظنت used to take a tissue sample or biopsy
Urogenital sample.
Duodenal aspiration.

Cllect the stool samples: -

A clean dry container must be used for the collection of faecal samples. It must be the container without:

- Urine.
- Detergent.
- Disinfectant.
- Water. Because these materials will destroy trophozoites, if present, and the presence of dirt also causes identification problems.

The container should be labeled by:

- Patient name.
- Date of specimen collection.
- Ask the patient what the time of specimen collection.

Ideally the specimen should be brought to the lab as soon as it is passed, to avoid deterioration of protozoa and alterations of the morphology of protozoa and helminths.

The specimen container should be clearly labelled with the name &age of patient, date and time of the specimen take.

An amount of stool adequate for parasite examination should be collected and a repeat sample requested if too little is supplied.

Diarrhoeal specimens, or those containing blood and mucus, should be examined immediately on arrival in the laboratory. The specimens may contain motile amoebic or flagellate trophozoites and may be missed if examination is delayed. Where amoebic dysentery is suggested, should be examined within twenty minutes of taken it.

Care of the microscope:

1. When carrying your microscope, always use two hands.
2. Keep lenses clear of slides.
3. After using immersion oil, clean the lens immediately.
4. Always clean carefully and with the appropriate cleaning solution.
5. Always use the dust cover when the microscope is not in use.
6. Turn the microscope off after use. Do not keep the light on all day as this will shorten the bulb's (light sours) life.